Biometric User Authentication & System Security

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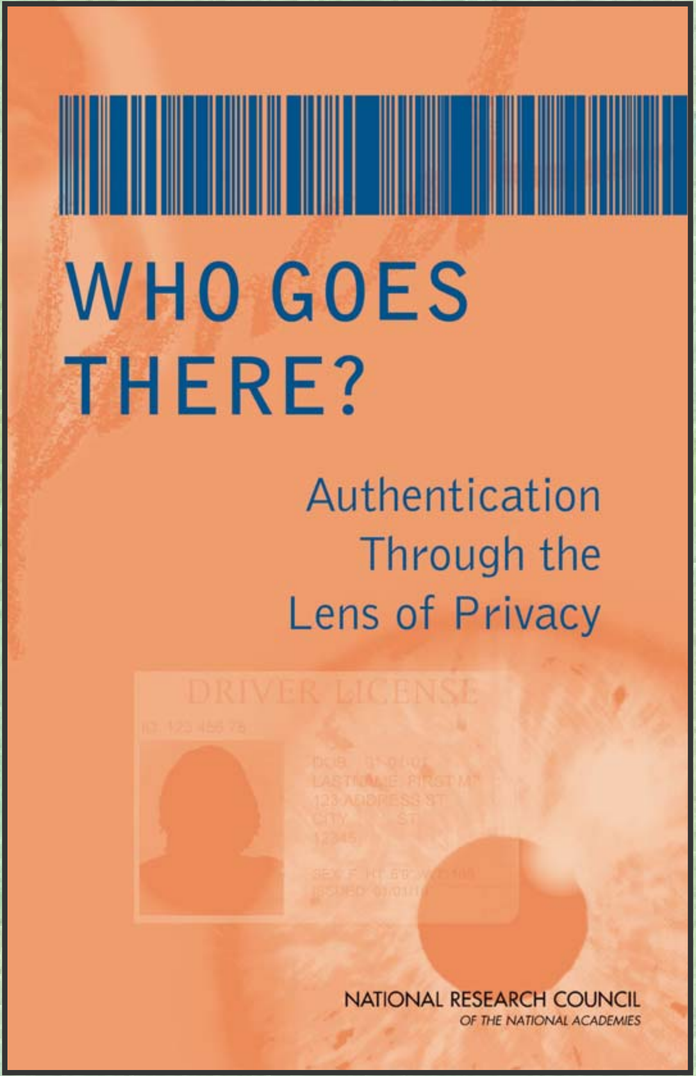
Today’s Topic

- Workshop charter
  - The objective of this workshop is to determine how biometrics can be used for remote e-authentication over open networks by providing equivalent authentication assurance to the conventional secret-based mechanisms defined in NIST Special Publication 800-63, for each of four authentication levels.
- My position
  - Maybe this is a bad idea
  - That was the conclusion of an NRC study committee

The NRC Report


WHO GOES THERE?
Authentication Through the Lens of Privacy
DRIVER LICENSE
NATIONAL RESEARCH COUNCIL
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Prepared by:

Committee on Authentication Technologies and Their Privacy Implications

Computer Science and Telecommunications Board

The National Academies
Washington, D.C.
http://cstb.org/

Obtain a hardcopy of the report from: http://www.nap.edu

Biometrics & Authentication

- Confidentiality
- Access control
- Integrity
- Non-repudiation
- Authentication
  - **Initial (one way) authentication**
    - Identifying a principal at the beginning of a session
  - Two-way authentication
    - Identifying the entity at each end (e.g., client & server)
  - Continuous authentication
    - Maintaining the binding between session traffic and the identities authenticated during session initiation

Biometric Authentication Model

- Initial registration (usually ”face to face”)
  - User identification
  - Feature capture
  - Template construction
- User authentication (may be local or remote)
  - Identity assertion
  - Feature capture
  - Scoring against registration template

Biometrics in Different Contexts

- Authentication to a PC
  - Usually one user, maybe a few
  - Local registration and template storage (on the PC itself, maybe in a local server)
- Authentication to a smart card
  - Very local storage, just one user, goal is logically unlocking (not decrypting) cryptographic key
- Authentication to a server
  - Typically many users, remote storage of templates
- Interpersonal authentication
  - Generally not feasible, e.g., e-mail sender authentication

Are Biometrics Better than Secrets?

- Typical vendor claims
  - More secure
  - Less expensive
  - More convenient
- But, relative to what alternative user authentication technology?
  - Static passwords
  - One-time passwords
  - Challenge-response systems
  - Smart cards
  - Cryptographic systems (Kerberos, PKI)

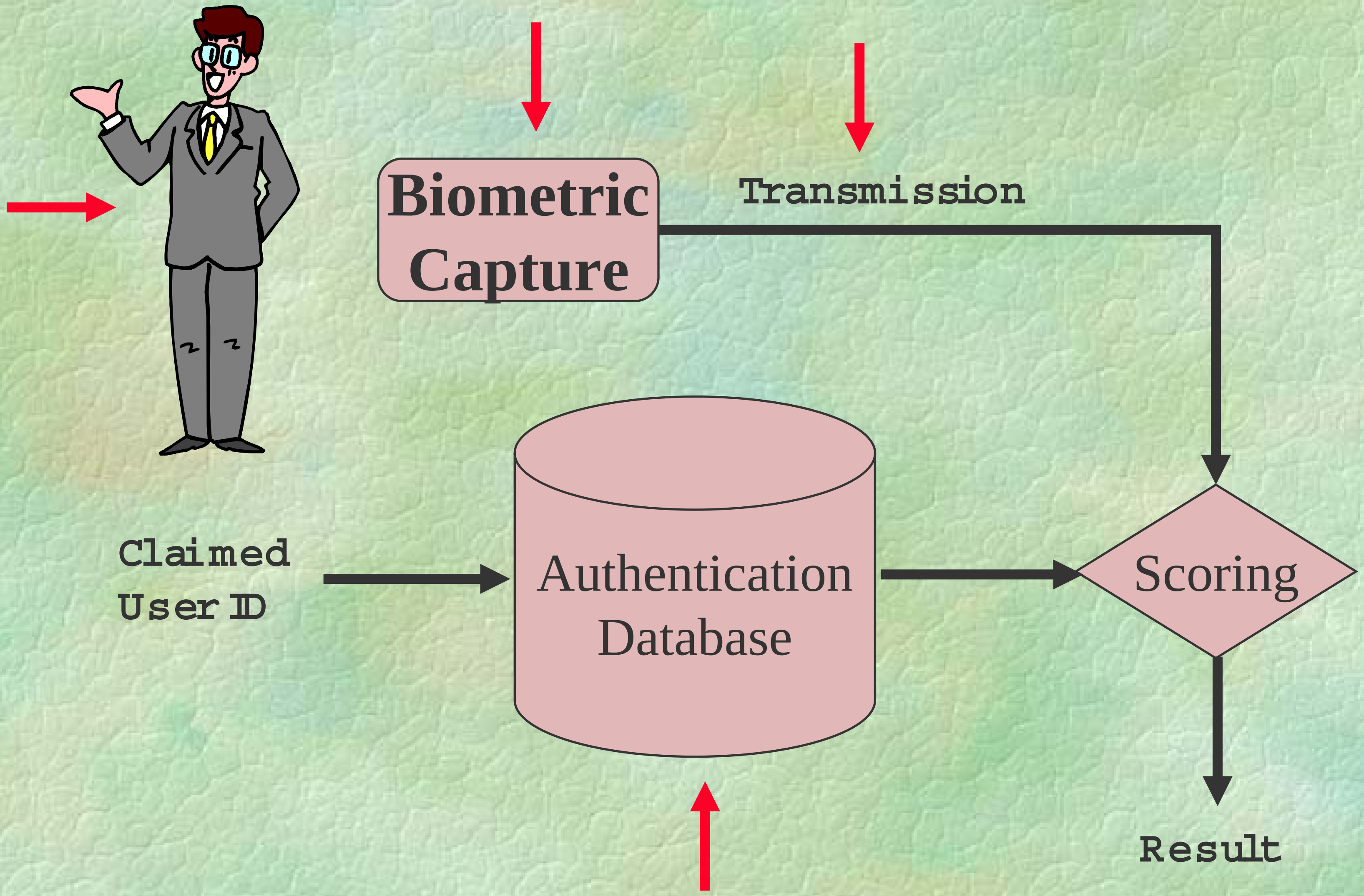
Truth in Advertising

- Biometric authentication can be much more convenient: nothing to remember, nothing to lose
- Capital costs are higher for biometric authentication, but life cycle costs could be lower, if not combined with a PIN/password
- But, typical systems using biometrics emphasize multi-factor authentication, excluding this possible benefit!

Are Biometrics More Secure?

- The security of biometric authentication must be evaluated relative to a perceived threat:
  - who are the adversaries?
  - what are their goals?
  - what are their capabilities?
- All biometric systems are imperfect, most have DET curves that are not very impressive, so as we tune to make systems “user friendly” we increase false positive %

Attack Points



Attacking Biometric Systems

- Fooling biometric sensors with fake body parts
- Using real body parts acquired from a user (e.g., in a non-cooperative fashion)
- Intercepting digitized biometric samples (transmission, compromised capture devices, …)
- Covert acquisition of biometric values from users
- Injecting purported biometric bit patterns into compromised capture devices
- Unauthorized acquisition of templates from authentication system components

Biometrics & Security

- Many computer/network authentication applications ultimately require crypto secrets
- Some biometric features are easily acquired and may be used to create bogus inputs to capture devices
- Most biometric capture devices used with PCs are vulnerable to many types of attacks, do not meet FIPS 140-2 criteria, …
- Authentication servers tend to store templates in a "recoverable" form that could be stolen
- We cannot change our biometric features as easily as we change passwords, PINs, or keys

A Worst Case Scenario

- A standardized biometric authentication technology is adopted on a widespread basis
- Biometric templates are stored on many servers
- Attackers break into one or more servers, stealing biometric templates
- Knowing the algorithms used and possessing user templates, attackers generate samples that mimic sample captures for these users (offline guessing)
- Attackers insert fake samples wherever capture system technology is not well protected

Good, Local Uses of Biometrics

- Authentication of a user to his/her PC
  - Used as the only factor in a home context where security is less important than convenience
  - Used with an additional factor in higher security contexts, as a means to counter password or physical token sharing
- Authentication of a user to a crypto token
  - To unlock a key, perhaps with a password/PIN
- Authentication of a user for physical access control in a physically well-protected context
  - Where tampering with the capture device is not likely

Workshop Questions

- 1. How can Federal agencies and other organizations use biometrics to authenticate unsupervised remote claimants whose computers and workstations they do not manage or control?
- 2. How do we compare the authentication assurance provided by unsupervised biometric methods to the conventional methods now defined in NIST Special Publication 800-63 ?
- 3. In what way could biometrics be appropriately used for each of the four authentication levels?
- 4. What constraints and protections need to be in place to use biometrics in a secure solution?

Answers?

- This may be an example of the worst possible case
  - No guarantee that transmitted bits represent a biometric
  - System relies on a giant database of templates, a juicy target!
- Biometrics used here are less flexible than secret-based mechanisms, e.g., can’t be used to sign a form or e-mail, which seems to limit secure user interaction options
- Use of biometrics don’t align with existing protocol standards for user authentication (e.g., SSL/TLS)
- Assurance seems less than level 4, maybe less than level 3
- Privacy concerns are MUCH greater that for any secret-based authentication mechanism

Conclusions

- Biometric user authentication technology can be convenient, may be cost effective, and can provide a secure basis for local authentication
- Cryptographic technology, e.g., PKI or Kerberos, usually is preferable for remote authentication
- Credible scenarios exist that could result in large scale exposure of user biometric templates and enable widespread spoofing of user identity
- Re the workshop questions, maybe Nancy Reagan’s famous words are appropriate:

  “Just Say No”

Faith-based User Authentication?

“User name and password?”